A.D. 1823 . . . . N° 4747.

SPECIFICATION

OF

WILLIAM JOHNSON.

ECONOMIZING FUEL IN PRODUCTION OF MOTIVE POWER FOR STEAM ENGINES.

LONDON:
PRINTED BY GEORGE E. EYRE AND WILLIAM SPOTTISWOODE,
PRINTERS TO THE QUEEN'S MOST EXCELLENT MAJESTY:
PUBLISHED AT THE QUEEN'S PRINTING OFFICE, EAST HARDING STREET,
NEAR FLEET STREET.
1854.

Price 7d.

A.D. 1823 . . . . N° 4747.

Economizing Fuel in Production of Motive Power for Steam Engines.

JOHNSON'S SPECIFICATION.

TO ALL TO WHOM THESE PRESENTS SHALL COME, I, William Johnson, of Great Totham, in the County of Essex, Gentleman, send greeting.

WHEREAS His most Excellent Majesty King George the Fourth, did, by His Letters Patent under the Great Seal of His United Kingdom, bearing date at Westminster, the Eighth day of January, 1823, in the fourth year of His reign, give and grant unto me, the said William Johnson, my ex̃ors, adm̃iors, and assigns, His especial licence, full power, sole privilege and authority, that I, the said William Johnson, my ex̃ors, adm̃iors, and assigns, during the term of years therein mentioned, should and lawfully might make, use, exercise, and vend, within England, Wales, and the Town of Berwick upon Tweed, and also in all His Majesty's Colonies and Plantations abroad, my Invention of "A Means of Obtaining the Power of Steam for the Use of Steam Engines with reduced Expenditure of Fuel;" in which said Letters Patent there is contained a proviso that if I, the said William Johnson, shall not particularly describe and ascertain the nature of my said Invention, and in what manner the same is to be performed, by an instrument in writing under my hand and seal, and cause the same to be inrolled in His Majesty's High Court of Chancery within six calendar months next and immediately after the date of the said Letters Patent, that then the said Letters

Patent, and all liberties and advantages whatsoever hereby granted, shall utterly cease, determine, and become void, as in and by the same, relation being thereunto had, will more fully and at large appear.

NOW KNOW YE, that in compliance with the said proviso, I, the said William Johnson, do hereby declare that the nature of my said Invention of a Means of Obtaining the Power of Steam for the Use of Steam Engines with reduced Expenditure of Fuel, and the manner in which the same is to be carried into effect and produced, is particularly described and set forth as follows, that is to say:—

I make use of a boiler formed of the ordinary or usual materials of which boilers are constructed, and which materials are to be joined together and united by any of the methods now in use for constructing boilers. This boiler is to be set over a furnace or fire-place in the usual way, and so far constitutes no part of my Invention; but instead of employing the process which has heretofore been adopted for supplying steam for the use of steam engines, my Invention consists in the use of a compound or multiplied boiler formed by placing a number of vessels, in which the fluid is to be boiled, one over the other, in such manner that supposing the lowest vessel to be open to the air at the top, the bottom of the next vessel above it may form a close or steam-tight cover to such lowest vessel, while in like manner the bottom of the third vessel will form a close top or cover to the second, and so on for any number of vessels that may be employed, except that the last or uppermost vessel of the series must have a close dome or cover applied to it, and need not be surmounted by any vessel to contain water or any other fluid. These vessels must have no openings or connections whatever with each other, but are each intended to contain the water or other fluid to be evaporated, and they must consequently each have separate pipes for filling them, and for the conveyance of the steam to the steam engine, which latter pipes must also be equipped with separate cocks, valves, or some of the other well-known contrivances for entirely stopping or regulating the discharge of the steam in any required proportion. It is also necessary to furnish each distinct chamber or boiler with a safety-valve, so constructed that its weights can be adjusted to any required degree of pressure of steam, or else that the ordinary mercurial steam gauges should be applied to them, or both may be used with advantage to ascertain and shew the degree of compression in each separate vessel, for upon the due regulation of this does the entire beneficial effect of my Invention and apparatus depend. One fire only is to be applied to my compound boiler above described, and this is to be situated in the usual manner under the lowest boiler or vessel above named, while the others should be built in brickwork, or surrounded by some bad conductor of heat, or the flue or chimney of the fire-place may wind round the outside of the upper vessels, it being of importance that the external radiation of heat from all the vessels should be prevented as effectually as possible. The beneficial effect to be derived from my Invention arises from the rapidity and facility with which the heat from the fire will radiate upwards in the interior of the compound boiler, and will pass through the several layers of water and air or steam, as well as through the several bottoms or partitions which divide them from each other, and this I find to take place to such an extent by means of the due government of the steam, that the same quantity of fuel which would be necessary to heat a common boiler or the lower vessel in my arrangement (if it was employed alone) will at the same time serve by this radiation to heat one, two, three, four, or more close vessels placed upon each other, as herein-before described. As the coloric which would be wasted in an open boiler by the dissipation of the steam, or which would radiate into the surrounding air in a close boiler, is thus applied to a beneficial purpose, and by such application a much greater quantity of water can be evaporated, and consequently of steam produced, with a certain quantity of fuel, than by any other process and form of boiler before in use, since it will be evident that each individual chamber or vessel in my compound boiler is in itself a distinct boiler, and will produce effective steam in quantity, and of a force proportionate to the heat which it receives from the vessel immediately underneath it, and which in the ordinary construction of boilers is wasted or thrown away. This additional quantity of steam which I produce is, I must premise, in consequence of the due regulation and management of the steam produced in the several vessels, and which therefore constitutes the cheif part of my present Invention, which has partly arisen from experiments which I have made with an apparatus not designed for the saving of fuel or to supply steam for the steam engine, but described in the Specification of an Invention intended for supplying the steam engine with steam and to save fuel, for which His late Majesty George the Third was graciously pleased to grant me his Royal Letters Patent, bearing date at Westminster the Fifteenth day of May, in the year of our Lord 1809, and in pursuance of which I caused a Specification of my said Invention, and the manner of carrying the same into effect, to be inrolled in the High Court of Chancery on or about the Fourteenth day of November then next following, as by reference thereto, will more fully and at large appear. In that said Specification I described and mentioned that a double boiler, or one boiler with a false bottom, fixed in the same, so as to enable it to contain two distinct quantities of fluid, might be used for the production of steam; but my view in giving that description was confined to the protection of the upper boiler from the immediate action of the fire by the introduction of oil or any other fluid between them, so as to produce the effects of what chemists call a balneum or bath of oil or water, and by which it is well known the power or action of the fire can be regulated to great nicety in all delicate chemical operations of boiling or evaporation, and to the evaporation of two fluids at the same time, when the lower one required a higher degree of heat than was necessary for the upper one. But not being aware at the time of making that Specification that any beneficial effects in the production of steam by a less quantity of fuel or from the employment of the power of that steam for a distinct purpose was to be expected would result from such an arrangement of a compound or multiplied boiler, or one consisting of vessels placed above each other, as herein-before described; I neither noticed such an effect, nor could I give any directions for the due management of the steam to produce it. What I therefore now claim the sole and exclusive benefit and advantage of, under my present and partly herein-before recited Patent of the Eighth day of January 1823, is the use of a compound or multiplied boiler, consisting of at least two, but more beneficially of three or more vessels placed one above the other, as herein-before described, to be used or worked for the production of steam for steam engines, with a diminished quantity of fuel obtained by an observance of the rules herein-after laid down, by which a new and useful combination and result will be obtained to the manufacturer; for even admitting the double form of boiler of which I am the inventor to have been given to the public by my former Specification before mentioned, still it was given for a purpose completely distinct and different from that for which I now use it, and therefore although it is not so efficient as the treble or more multiplied form of boiler, still I claim to use it for the aforesaid new means of operating with it for a new purpose and effect under my present Patent. The description herein-before given will, I believe, be sufficient to enable any competent workman to construct my new boiler and apparatus; but to render not only its construction but the mode of working or using it more clear, I have annexed three representations of distinct modes of applying it for working a steam engine, and in the whole of these the same letters of reference are used to denote the same parts, A being the first or lowest boiler to which the fire is immediately applied; B, the second boiler next above A; C, the third; and D the fourth, which, it will be observed, is made close by a dome or cover; the intermediate vessels, and which, as before observed, may be more or less in number than shewn in the Figure, according to the heat that is intended to be applied under the lowest boiler, or preserved within it, are formed of metal cylinders with flanges, having flat or curved plates between them, which serve at once for the top of one vessel and the bottom of that next above it, the joints round the flanges being made steam-tight by bolts and nuts with packing, or by any other means in use. The dotted lines drawn across the several boilers are to shew the height near which the water within them should stand. *g*, *g*, *g*, *g*, are tubes placed as near as possible to the top of each separate vessel, and upon some part of which are to be fixed the loaded safety valves or mercurial steam gauges before mentioned, and another set of pipes must also be affixed upon some convenient part of each vessel, for the purpose of feeding them with a fresh supply of water by any of the usual modes, as that which they previously contained boils away. *h*, *h*, *h*, *h*, are the steam pipes for conveying the steam to the steam engine or place where it is to act. One of these steam pipes must proceed from the uppermost part of each of the said vessels or boilers, and each steam pipe must have a cock or valve capable of very nice opening and adjustment in some part of it, as at *i*, *i*, *i*, *i*, by which the passage of the steam is to be regulated, and upon which, as I before observed, the whole beneficial action of my Invention depends. To use the apparatus, charge all the separate vessels or boilers with their necessary quantity of fluid, or fill them from half to two-thirds full, shut all the steam cocks *i*, *i*, *i*, *i*, and apply fire under the lowest vessel A; the air contained above the water in it will, by its expansion, soon escape at the safety valve, and this will be followed by steam as soon as the water boils under the pressure of its safety valve, which must be regulated to about sixteen or eighteen pounds pressure on the square inch, but may be less or more at pleasure, according to the strength of the apparatus, or the power of steam required. It will be evident, then, that steam equal to the pressure of about eighteen pounds to the inch will be generated in the lower boiler with the same quantity of fuel that would be necessary for its production by the common or ordinary process with a single close boiler, and from which single boiler no other or greater advantage could be procured. But by placing the boiler B above the lowest one, and so regulating the steam as aforesaid and hereafter described, I save all the heat that would otherwise be wasted in radiation from A, and find that I can boil the water in B, and produce steam in it equal to about eleven pounds pressure on the square inch, without the use of any additional fuel; consequently all the steam that is produced in B, and which of itself (if the apparatus is large enough) will be capable of working a separate steam engine, is so much positive saving in fuel by my Invention. And as the surplus heat of A is sufficient to boil water in B, so is the surplus heat of B, when it contains steam, equal to about eleven pounds on the square inch, capable of boiling water in C, and of producing steam equal in elastic force to about seven pounds on the square inch, and by the same rule C will communicate heat to D sufficient to produce steam of about three or four pounds force, and so on for a greater number of vessels, which number must, however, depend upon the heat communicated in the first instance to the lower vessel A, and the force of steam maintained in it, as well as in the intermediate vessels B, C, &c., all which can be very well regulated by the steam cocks *i*, *i*, *i*, *i*, which must be opened respectively in a due degree, to permit the steam to escape to the steam engine to perform its work, but in no case to such an extent as to permit the lower vessels to be reduced in temperature so as to loose their due elasticity of steam, which may be accurately preserved by observance of the mercurial steam gauges fixed upon the pipes *g*, *g*, *g*, *g*. In the same way it will be found, if high pressure steam is preferred, that while the lower vessel A is worked to about seventy pounds upon the square inch, the second vessel B will produce steam of about sixty pounds pressure, the next C of about fifty-two pounds, and the upper one D of about forty-five pounds on the square inch: consequently a greater number of vessels may be employed, if thought necessary. It must be observed, that if the higher pressure of steam produced in the lower vessels A and B had immediate access to the upper vessels C and D, it would, by its pressure upon the water contained in them, prevent it boiling at all, and consequently they would produce no steam. To obviate this, I find it necessary either to convey the steam pipe from each separate vessel to the separate working cylinder of so many distinct engines, which may thus be worked by one of my compound boilers, as shewn at *k*, *k*, *k*, *k*, Fig. 3, or else to use an equalizing vessel, as shewn at E in Fig. 1, and at G in Fig. 2. The equalizing vessel G, in Fig. 2, is meant to represent a section of a common waggon boiler, of an ordinary low pressure or condensing engine; this boiler must be sufficient capacity to allow the steam to expand to the temperature required, and must contain a quantity of water through which the steam from the several steam pipes *h*, *h*, *h*, *h*, is made to pass, by which that water is made to boil, and its steam mixing with that which issues from the steam pipes may also be applied to work a steam engine by passing off through the pipe *k*. The arrangement which I most prefer is, however, shewn at Fig. 1, and in which all the separate steam pipes *h*, *h*, *h*, *h*, deliver their steam into the equalizing vessel E, which must be of such magnitude and kept at such a temperature with respect to the lower vessel A as to permit the more powerful steam to expand and equalize itself with that of less power proceeding from the upper vessel; and the more beneficially to produce this end, the vessel E may be connected by a side flue (having a damper) with the fire, so that its heat may

FIG. 1.

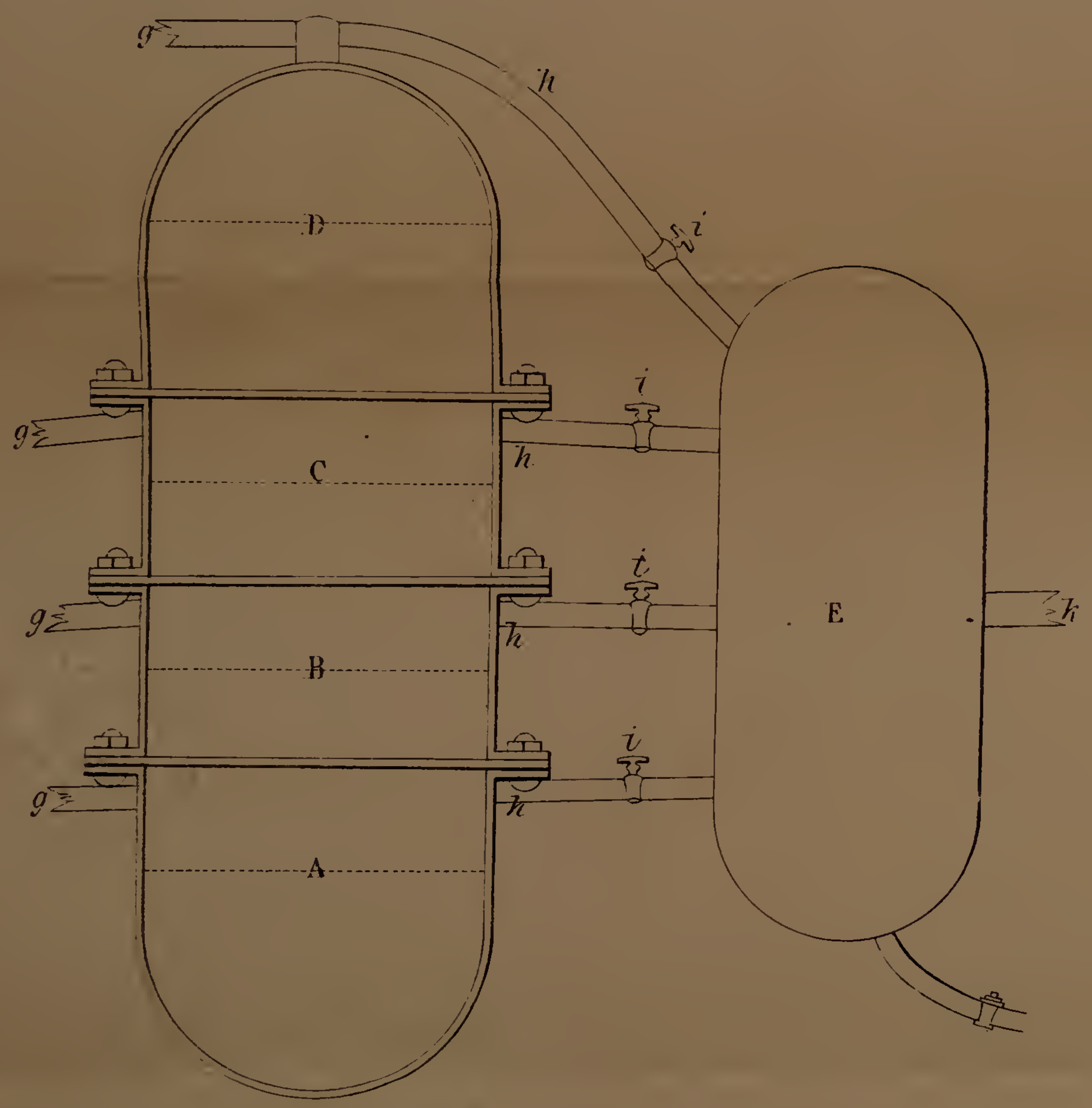


FIG. 2.

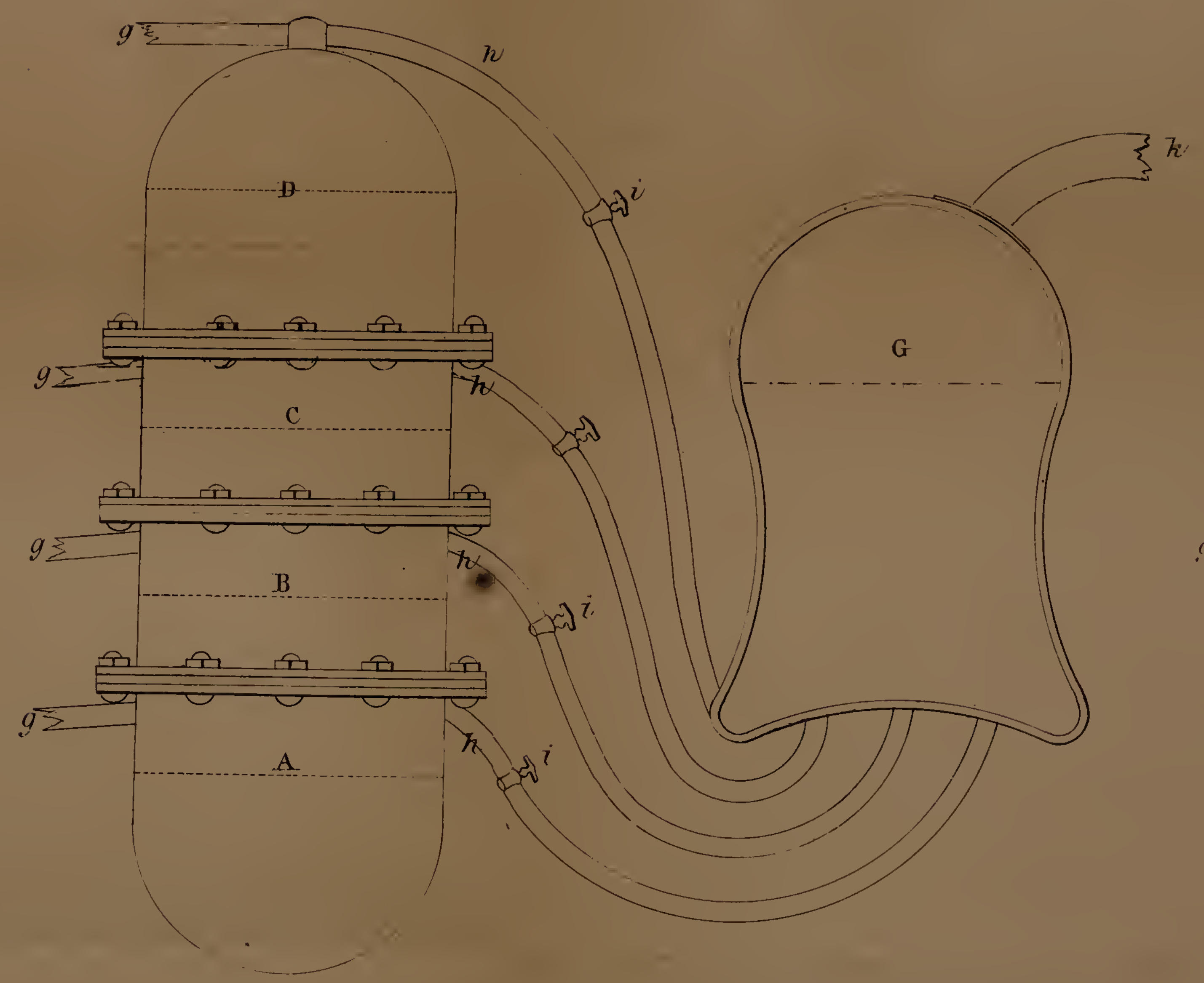
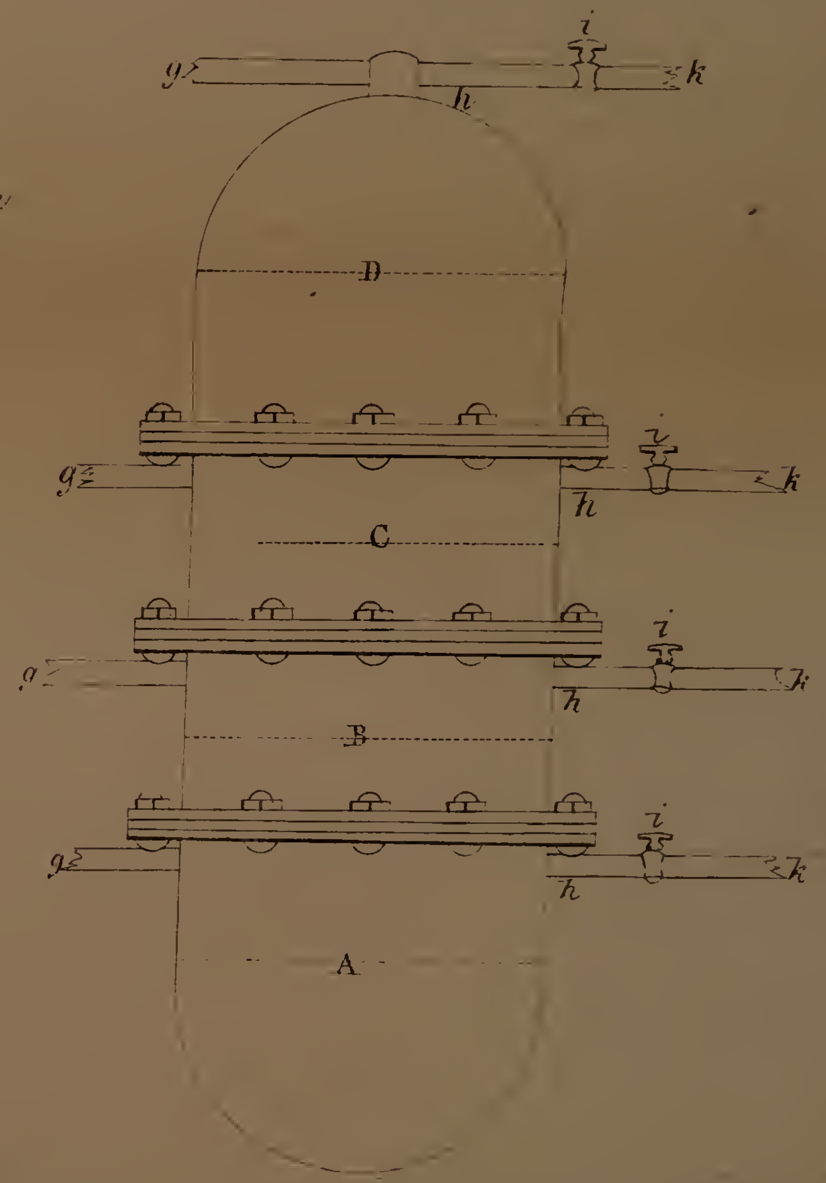


FIG. 3.



The enrolled drawing is colored

London: Printed by George Edward Eyre and William Spottiswoode
Printers to the Queen's most Excellent Majesty 1854.

be increased, or it may have a jet of cold water playing into or upon it for the purpose of occasionally cooling it. By the intervention of such a vessel, steam of any required pressure may be prepared, according to the heat employed in the primitive or lower vessel of the multiplied boiler; I therefore consider such vessel as part of my said Invention, which includes the construction and use of a compound boiler and an equalifying vessel, as aforesaid, worked and regulated as to the strength of steam in the different vessels according to the manner herein-before described, that is to say, by a maintenance of the strongest power of steam in the lowest vessel or boiler, such pressure diminishing gradually in the several vessels as they proceed upwards from the fire, which regulation is to be brought about and maintained by the due opening of the steam cocks, such opening to be ascertained by inspection of the mercurial guages or loaded safety valves, or such other contrivances as may be used for determining the strength of the steam in the respective boilers. But I disclaim all exclusive right or title to the use of such steam vessels, cocks, valves, safety valves, mercurial guages, steam pipes, feed pipes, or pumps, furnaces, or other matters and things as have been heretofore invented or in use, save only so far as the same are connected with the necessary construction, performance, and use of my said herein-before described compound or multiplied boiler and equalizing vessel, and the methods of using them, as aforesaid.

In witness whereof, I, the said William Johnson, have hereunto set my hand and seal, this Eighth day of July, in the year of our Lord One thousand eight hundred and twenty-three.

W^M (L.S.) JOHNSON.

AND BE IT REMEMBERED, that on the Eighth day of July, in the year of our Lord 1823, the aforesaid William Johnson came before our said Lord the King in His Chancery, and acknowledged the Specification aforesaid, and all and every thing therein contained and specified, in form above written. And also the Specification aforesaid was stamp't according to the tenor of the Statute made for that purpose.

Inrolled the Eighth day of July, in the year of our Lord One thousand eight hundred and twenty-three.

Camp & Ell.

LONDON:
Printed by George Edward Eyre and William Spottiswoode,
Printers to the Queen's most Excellent Majesty. 1854.